CLAIMS

1. A method executable by a programmed processor for generating a binary Gray code, comprising:

providing an *n*-bit binary Gray code C^n ;

using C^n , generating an n+2 bit binary Gray code C^{n+2} having 4M code words c^n_0 through c^n_{N-1} where N is less than or equal to 2^n , by:

changing the leftmost bit between the code words c^n_0 and c^n_1 ;

finding the largest value M such that the rightmost bit changes between code words c^n_{M-2} and c^n_{M-1} ; and

forming 4M code words of C^{n+2} by extending the first M code words of C^n by a single bit at each end, with reversals in the order of the code words of C^n as required to yield an extended code X, wherein:

$$x_k^{n+2} = \begin{cases} [0, & c_k^n, & 0], & 0 < k \le M \\ [0, & c_{M-k+1}^n, & 1], & M < k \le 2M \\ [1, & c_k^n, & 1], & 2M < k \le 3M \\ [1, & c_{M-k+1}^n, & 0], & 3M < k \le 4M \end{cases}$$

- 2. The method of claim 1, wherein the *n*-bit binary code is a single bit binary code.
- 3. The method of claim 1, wherein the *n*-bit binary code is a two-bit binary code.
- 4. The method of claim 3, wherein the two bit binary code is given by a code table having four code words in the order {01}, {11}, {10},{00}.
- 5. The method of claim 1, wherein the n-bit binary code is a three-bit binary code.

HSJ8-2003-0161

- 6. The method of claim 5, wherein the three bit binary code is given by a code table having eight code words in the order {110}, {010}, {000}, {001}, {011}, {111}, {101}, {100}.
- 7. A method executable by a programmed processor for generating a skew-tolerant Gray code having code words with co-ordinate positions, comprising: receiving a number n representing the length of the code words;

if n is equal to or less than 3, selecting a predetermined code table containing 2, 4, or 8 code words, in which the predetermined tables having 4 or eight code words are characterized by at least two properties:

a first property that consecutive code words differ in only one coordinate position;

and a second property that, in each consecutive group of three consecutive code words, the first and third code words differ in only two adjacent coordinate positions;

otherwise, if n is even, selecting the predetermined code table containing 4 code words as a first code table, or if n is odd, selecting the predetermined code table with 8 code words as the first code table; and then performing the following recursion,

setting a parameter L to a value equal to the number of code words in the first code table;

forming a second code table from the first (3L/4+2) code words in the first code table;

forming a third code table by adding a zero at the beginning and end of each code word in the second code table;

forming a fourth code table by adding a one at the beginning and end of each code word in the second code table;

forming a fifth code table by reversing the order of code words in the second code table;

forming a sixth code table by adding a zero at the beginning and a one at the end of each code word in the fifth code table:

forming a seventh code table by adding a one at the beginning and a zero at the end of each code word in the fifth code table;

forming an eighth code table by concatenating corresponding code words of the third, fourth, sixth, and seventh code tables;

if the length of the code words in the eighth code table is less than n, continuing the recursion using the eighth code table as the first code table; otherwise, ending the recursion.

- 8. The method of claim 7, wherein the predetermined code table having four code words is given by the four code words in the order {01}, {11}, {10},{00}.
- 9. The method of claim 7, wherein the predetermined code table having eight code words is given by the eight code words in the order {110}, {010}, {000}, {001}, {011}, {111}, {101}, {100}.
- 10. A program medium having computer-readable code means for performing a method to generate a binary Gray code, the method comprising: providing an n-bit binary Gray code C^n ;

using C^n , generating an n+2 bit binary Gray code C^{n+2} having 4M code words c^n_0 through c^n_{N-1} , where N is less than or equal to 2^n , by:

changing the leftmost bit between the code words c^{n}_{0} and c^{n}_{1} ;

finding the largest value M such that the rightmost bit changes between code words c^{n}_{M-2} and c^{n}_{M-1} ; and

forming 4M code words of C^{n+2} by extending the first M code words of C^n by a single bit at each end, with reversals in the order of the code words of C^n as required to yield an extended code X, wherein:

$$x_k^{n+2} = \begin{cases} \begin{bmatrix} 0, & c_k^n, & 0 \end{bmatrix}, & 0 < k \le M \\ \begin{bmatrix} 0, & c_{M-k+1}^n, & 1 \end{bmatrix}, & M < k \le 2M \\ \begin{bmatrix} 1, & c_k^n, & 1 \end{bmatrix}, & 2M < k \le 3M \\ \begin{bmatrix} 1, & c_{M-k+1}^n, & 0 \end{bmatrix}, & 3M < k \le 4M \end{cases}$$

- 11. The program medium of claim 10, wherein the n-bit binary code is a single bit binary code.
- 12. The program medium of claim 10, wherein the *n*-bit binary code is a two-bit binary code.
- 13. The program medium of claim 12, wherein the two bit binary code is given by a code table having four code words in the order {01}, {11}, {10}, {00}.
- 14. The program medium of claim 10, wherein the *n*-bit binary code is a three-bit binary code.
- 15. The program medium of claim 14, wherein the three bit binary code is given by a code table having eight code words in the order {110}, {010}, {000}, {001}, {011}, {111}, {101}, {100}.
- 16. A program medium having computer-readable code means for performing a method to generate a skew-tolerant Gray code having code words with co-ordinate positions, comprising:

receiving a number n representing the length of the code words;

if n is equal to or less than 3, selecting a predetermined code table containing 2, 4, or 8 code words, in which the predetermined tables having 4 or eight code words are characterized by at least two properties:

a first property that consecutive code words differ in only one coordinate position;

and a second property that, in each consecutive group of three consecutive code words, the first and third code words differ in only two adjacent coordinate positions;

otherwise, if n is even, selecting the predetermined code table containing 4 code words as a first code table, or if n is odd, selecting the predetermined code table with 8 code words as the first code table; and then performing the following recursion,

setting a parameter L to a value equal to the number of code words in the first code table;

forming a second code table from the first (3L/4+2) code words in the first code table;

forming a third code table by adding a zero at the beginning and end of each code word in the second code table;

forming a fourth code table by adding a one at the beginning and end of each code word in the second code table;

forming a fifth code table by reversing the order of code words in the second code table;

forming a sixth code table by adding a zero at the beginning and a one at the end of each code word in the fifth code table;

forming a seventh code table by adding a one at the beginning and a zero at the end of each code word in the fifth code table;

forming an eighth code table by concatenating, in order, the rows of the third, sixth, fourth, and seventh code tables;

if the length of the code words in the eighth code table is less than n, continuing the recursion using the eighth code table as the first code table; otherwise, ending the recursion.

- 17. The program medium of claim 16, wherein the predetermined code table having four code words is given by the four code words in the order {01}, {11}, {10},{00}.
- 18. The program medium of claim 16, wherein the predetermined code table having eight code words is given by the eight code words in the order {110}, {010}, {000}, {001}, {011}, {111}, {101}, {100}.

19. An apparatus for decoding a code word of a skew-tolerant Gray code sequence, comprising:

a first selector responsive to a root code word in the code word for selecting an initial code sequence position p;

at least a second selector responsive to an extension of the root code word in the code word for selecting sign and offset values with which to adjust p;

at least one arithmetic unit for combining the sign value with p to produce a signed value of p;

at least one arithmetic unit for combining the signed value of p with the offset value to produce an interim value of p; and

at least one arithmetic unit for performing a modulo calculation of the interim value of p to produce an adjusted value of p.

- 20. The apparatus of claim 19, further including a lookup table associating root code words with respective values of p, wherein the first selector includes a multiplexer having a control input for receiving a root code word and a data input for receiving a value of p from the table which is associated with the root code word received by the control input.
- 21. The apparatus of claim 21, further including at least one lookup table associating extensions of the root code word with sign and offset values, wherein the at least a second selector includes a multiplexer having a control input for receiving an extension of the root code word and a data input for receiving sign and offset values from the at least one lookup table which are associated with the extension.